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They are scoria cones, none of them probably rising more than 1000 feet above their base. Many have breached craters, whence floods of black basaltic lava have flowed. The almost perfect state of preservation of the cones and the undecomposed condition of the lava proves that these volcanoes must have been active in comparatively recent times.——Scarcely a year passes without one or more earthquake shocks in Central Madagascar, but they are never severe nor of long duration.——Cardinal Massaja has published at Rome a work entitled "My thirty-five mission years in Upper Ethiopia." Numerous illustrations and a good map accompany the text.

## GEOLOGY AND PALÆONTOLOGY.

THE FOSSIL MAN OF PEÑON, MEXICO.—On my return to this city after a long absence, I read the observations published in the *New York Tribune* concerning my account of the fossil man of the Peñon.

It will give me great pleasure to clear up the doubt expressed by Professor Newberry with regard to the importance of the discovery of the man of the Peñon.

Professor Newberry does not believe in the importance of the discovery, and argues in this manner: "The calcareous bed in which the fossil remains were found must have been modern travertin; it could not have been deposited below the waters of a lake, but probably belongs to an aërial or superficial formation, since otherwise it would be of equal thickness and uniform on the bottom and on the borders of the lake; if the limestone is siliceous, it must belong to a hydrothermal deposit."

It is above all certain that the limestone is not modern travertin, for it does not form concentric layers above the human remains, nor over other recent objects, as would be the case were it such. The bones are sealed up, so to speak, in the calcareous rock, without being in any way coated, and were probably deposited while the rock was yet soft and under water. As the clearances and excavations at the foot of the small mountain of Peñon have been continued, I have been able to prove the persistence of the facts indicated in my article published in the NATURALIST, August, 1885, as well as in a fuller account of the same subject published in 1884 by Professor Antonio del Castillo and by me.

The new excavations have shown more clearly yet the three formations of which I have spoken, ranged as follows:

(1) A superficial layer 10 centimeters thick, formed of vegetable earth, containing lacustrine shells and fragments of modern pottery.

(2) A layer of calcareo-siliceous tufa, of but slight hardness, with remains of old pottery, 50 centimeters thick.

(3) Siliceous limestone, very hard, in a thick bed, inclined towards the north. Here are found roots transformed into *men-*

*ilite* and lacustrine shells. It is in this bed that human remains, and no others, have been found. The thickness of this bed is not yet known, as it has only been opened to a depth of 1.2$^{\text{m}}$. The bed is covered by a thin layer of a limestone richer in quartz, a true ribbon, dividing the adjacent formations.

Not a single modern object has been found in this bed, nor in another similar one situated to the south of the mountain, more than a meter thick, and resting on a lacustrine and turfy formation.

Two miles northwest of Peñon there is another bed of siliceous limestone at the foot of the mountain chain of Guadalupe, and stretching over a great length. This limestone is in composition, appearance and position, identical with that of Peñon, containing roots transformed into menillite, and in its upper part fragments of old pottery. What is most important in this formation *is the existence of elephant bones sealed in the hardest bed, like that of Peñon.* These bones have been taken out on many occasions. I have done it myself in the presence of the professors of the National Museum.

The distance from this bed to that of Peñon is so inconsiderable, and the circumstances and physical character are so similar, that this bed and that of Peñon can be considered as belonging to the same geological horizon, so long as no object indicating a different horizon is found in the latter. Meanwhile all our observations induce us to believe in the contemporaneity of the man of Peñon and of the mammoth in the valley of Mexico.

I must now show why, according to my belief, the limestone of Peñon was once engulfed below the waters of the lake. In the first place, it is evident that the bed has been raised and tilted, so as to occupy a position different from its primitive one, and, the Peñon having for an enormous number of years been surrounded by water, we must believe that the calcareous bed, which is now three meters above the level of the lake, was covered with water during the same interval. Besides, it contains the shells of Paludina and other aquatic species, and this dissipates all remaining doubt of its former position beneath the waters of the lake.

Professor Newberry is correct in remarking that it is very rarely that lime, which in the first instance is dissolved in water in the state of carbonate, is not precipitated so as to form a uniform bed over the bottom of the lake. This is the ordinary case, and what might be expected; but the deposit has only been observed in isolated masses, and the peculiarity can be explained by supposing that the bed has been buried deeply below its actual surface and covered by the modern deposits of the lake in many places, though this cannot yet be stated as a proved fact. The hydrothermal origin, which I have attributed to the limestone in the article in the NATURALIST, has been proved by later observations, for in many fissures of the Peñon rock thin veins are found composed of calcareous matter in some cases, of siliceous in others. Besides, upon the summit of the Guadalupe mountains occur masses of shell-rock (*masses lavignes*) impregnated with siliceous limestone, which demonstrates their contemporary origin. What hinders me from believing that the existing hydrothermal springs at the foot of the Peñon can be the origin of the formation which surrounds the mountain is that these springs form only isolated and insignificant deposits, which cannot spread out uniformly like the limestone beds; at most they could form accumulations like those of which Professor Newberry speaks, and which are characteristic of geysers. The above-mentioned springs were probably the last traces of the abundant eruptions of calcareo-siliceous waters which formerly shot forth at the same time with lava, as at Peñon and at many other points in the valley of Mexico. The superficial revetements are caused by the solution and precipitation of the materials which cover the upper rocks, of the veins, or of the alteration of the basalts of the mountain. We must, therefore, believe in the importance of the discovery of the man of the Peñon.

No one can be more anxious than I to base these discoveries upon clear and well-determined facts, as I stated in my article in the NATURALIST. Professor Castillo and myself have assiduously studied the Peñon formations, and with the sincerity which scientific truth exacts we will inform the learned world of later discoveries. If it should happen that in the rocky tomb of the man of the Peñon the remains of his primitive weapons or the iron of his conqueror should be found, we shall doubtless be the first to announce it.—*Mariano Barcena.*

ON THE FOSSIL FLORA OF THE LARAMIE SERIES OF WESTERN CANADA.[1]—The Laramie series, formerly known as the Lignite Tertiary or Lignitic group, occurs in Canada, principally in two large areas west of the 100th meridian and east of the Rocky mountains, and stretching northward from the United States boundary. These areas are separated from each other by a low anticlinal of Cretaceous beds, over which the Laramie may have extended previously to the later denudation of the region.

These areas may be designated—(1) The Eastern or Souris River and Wood Mountain area; (2) the Western area, extending along the eastern side of the Rocky mountains and across the upper waters of the Bow, Red Deer, Battle and North Saskatchewan rivers.

In the southern part of the district of Alberta it has been found possible to divide the Laramie into three parts, which have been named respectively, in the Reports of the Geological Survey of Canada, (1) the lower or St. Mary River division, (2) the middle or Willow Creek division, and (3) the upper or Porcupine

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[1] Abstract of a paper read before the Royal Society of Canada, May, 1886, by Sir William Dawson, LL.D., F.R.S.

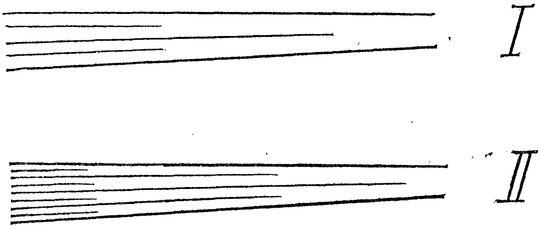
Hill division. Of these the lower and upper contain fossil plants, more especially the latter, and corresponding horizons can be recognized by these in both of the great areas above referred to. The flora of the lower division has a close alliance with that of the Belly River group of the underlying Cretaceous, while that of the upper division is in the main identical with that of the Fort Union group of the United States geologists, as described by Newberry and Lesquereux.

In the Eastern area the lower beds of the Laramie rest on the Fox Hill group of the Cretaceous, and are in turn unconformably overlaid in the Cypress hills by beds referred, by Professor Cope on the evidence of mammalian remains, to the White River division of the Miocene Tertiary. Thus the geological horizon of the Laramie is fixed by its stratigraphical relations as between the Upper Cretaceous and Lower Miocene formations. The evidence of fossil remains accords with this position. The Lower Laramie has afforded reptilian remains of Mesozoic aspect, associated with fishes and mollusks, some of which are of Eocene types, according to Cope and Whiteaves, and its flora is akin to that of the Upper Cretaceous. The Upper Laramie has afforded a flora so modern in aspect that it has even been regarded as Miocene, though in reality not later in age than the Eocene. The Willow Creek or Middle Laramie division may therefore (as suggested by the author in his memoir of last year on the Western Cretaceous) be regarded as the transition from the Cretaceous to the Eocene.

The question of the correlation of the Laramie with other formations has been much complicated by the reference in the United States and elsewhere, of beds holding its flora to the Miocene period, and these difficulties cannot as yet be wholly overcome, though they are gradually being removed. In Canada, since the plants began to be collected and studied, there has been little doubt on the subject, and the author now, as heretofore, holds to the correlation with the Laramie flora of the so-called Miocene of Mackenzie river, Alaska, Greenland and Spitzbergen, and believes that they should be regarded as not newer than Eocene.

The greater part of the paper is occupied with the description of the fossil plants of the formation, including those collected in the Eastern area by Dr. Selwyn and Dr. G. M. Dawson, and those obtained from the Western area by the latter, Mr. Weston, Mr. Tyrrell and the author. These include a large number of exogenous trees, all belonging to modern genera, as Platanus, Corylus, Populus, Salix, Viburnum, Carya, Juglans, etc. There are also some curious plants allied to the modern trapa or water chestnut and coniferous trees of the genera Taxodium, Sequoia and Salisburia, as well as some ferns and equisetaceous plants of much interest, more especially in reference to their geological and geographical distribution.

Notes on the Variation of certain Tertiary Fossils in overlying Beds.—In the Southwestern Old-tertiary there are some high vertical exposures, which show different fossiliferous beds vertically above each other. One of them is the profile near Vicksburg, described in the *Amer. Journ. of Science*, xxx, 1885, p. 71. The "Higher Vicksburgian," consisting mainly of reddish sands, contains those fossils usually known as Vicksburgian fossils; the bed, "Lower Vicksburgian," a dark grayish marl, contains a very similar but not entirely identical and less numerous fauna; both are separated by about thirty feet of limestone. Some of the lower species are not known from the higher bed, which, however, is at least partly owing to different methods of collecting in both beds. The main number of species of the lower bed occurs also in the higher one. In most of them, for instance, *Buccinum mississippiense* Conr., *Sigaretus mississippiensis* Conr., *Pleurotoma congesta* Conr., *Murex mississippiensis* Conr., *Terebra divisura* Conr., *Trochita trochiformis* Lea, *Turritella cœlatura* Conr., I cannot detect differences between the forms in the higher and lower bed; but in two cases at least there occur differences; *Cytherea sobrina* Conr. from the lower bed is in general longer than from the higher bed. Ten specimens of the higher bed, taken without special selection, showed, if the height is put as 1.00, a length varying from 1.19 to 1.29, with an average length of 1.23. Ten specimens of the lower bed, also taken without special selection, had a length varying from 1.24 to 1.33, with an average of 1.30. More striking is the relation of the two forms of *Ficus mississippiensis* Conr., which species in the lower bed is quite common. In the form of the higher bed the revolving lines are more developed. On the end volutions of the same age and size in both varieties, the higher variety shows one more system of revolving lines. This difference between the two varieties is not very striking, but is large and constant enough to distinguish the forms of the two beds without reference to the lithological contents of the shells. The following diagram represents the plan of the origin of the revolving lines as they can be traced along the volutions of each form:



I, lines of the form of the "Lower Vicksburgian;" II, lines of the form of the "Higher Vicksburgian."

The conclusion to be made is that the two species changed somewhat during the time which is represented by the bed of limestone.

By the Geological Survey of Alabama there has been made out, by a series of profiles, that certain fossiliferous Tertiary beds are successional in age, for instance, that the Woods Bluff beds are older than that of Hatchitigbee bluff, this again is older than the Lisbon strata, which finally are overlaid by the Claibornian. In these consecutive beds we frequently find the same species, sometimes without apparent change, sometimes represented by slight variations and in some cases by strongly modified variations. This material from Alabama, which I refer to, is in the collection of Mr. T. H. Aldrich.—*Otto Meyer.*

GEOLOGICAL NEWS.—*General.*—Capt. Dutton, in his memoir upon the volcanoes of the Pacific islands, examines and rejects the following four theories of the origin of volcanic action: (1) Access of water; (2) penetration of oxygen; (3) mechanical crushing through the horizontal pressure due to the cooling of the interior; (4) local development of heat from unknown causes. Elevatory movements are by him referred to expansion or to an increase of matter, and the former hypothesis is accepted as agreeing best with observed facts.——Among the samples of rocks collected during the soundings of the *Talisman*, mostly from depths of 4000 to 5000 meters, the older metamorphic rocks are more generally represented than the eruptive series. There were seventy-three specimens of limestones, sixteen of arkoses and nineteen of sandstones, the latter sometimes rich in remains of biotite and muscovite.——From the collections of Lieut. Giraud it appears that the region of Lakes Tanganyika and Nyassa is principally composed of primitive rocks. Schistose rocks, containing remains of Lepidosteus, were collected at Yendivé, south of Tanganyika, and at Mpasa, north-west of Nyassa. These are referred by Reymond to the Upper Cretaceous or Lower Tertiary age.

*Palæozoic.*—The occurrence of glacial conditions in the Palæozoic era was maintained by Dr. W. T. Blanford in a recent communication to the London Geological Society. The action of ice was evident in the Karoo formation of South Africa, the Gondwana system of India, and the coal measures and associated beds of Eastern Australia. Mr. R. Oldham, the Rev. W. B. Clarke and others had clearly showed that in Australia beds, containing Glossopteris, Phyllotheca and Nœggerathiopsis were intercalated among marine beds and Carboniferous fossils. Abundance of smooth and striated boulders had been found by Mr. Oldham in the marine Carboniferous beds north of Newcastle, N. S. W. Other boulder beds existed in the Talchir beds of India, and also near Herat in beds also containing Talchir fossils. Dr. Blanford considered it probable that these boulder-beds marked approximately the same glacial period, which probably occurred towards the close of the Palæozoic, and resulted in the extinction of many of its peculiar forms. The peculiar flora of the Newcastle beds and of the Indian Damudas proved the existence of botanical provinces in past ages.

*Tertiary.*—M. Cotteau has submitted to the Paris Acad. of Sciences a description of the Eocene species of the echinid genera Sarcella, Gualtieria, Echinocardium, Leiopneustes and Brissospatangus. *Sarcella sulcata*, peculiar to the Upper Eocene beds of Biarritz, is remarkable for its large and strongly strobiculated tubercles, the arrangement of its internal fasciole and the peculiar structure of its ambulacral areas; *Leiopneustes antiquus* has no fascioles; and *Brissospatangus canmonti* may be known by its very excentric anteriorly placed ambulacral summit and its short, transverse and widely separated anterior paired ambulacra, situated in a depression. The Brissidæ appear in the Cretaceous, reach their maximum in the Tertiary and still persist in most seas.——The Cretaceo-Eocene limestones of the Jaulan and Hauran regions, described by Mr. G. Schumacher, seem to have been deposited, upraised and largely denuded, before the volcanic lavas of the district were forced out. As this movement and denudation took place in the Miocene epoch, the volcanic eruptions may be referred in the main to the succeeding Pliocene.——The so-called delta of the Orinoco, according to A. Ernst (*Nature*, Feb., 4th), has not been formed by the river. At the end of the Tertiary period a sudden subsidence formed the Golfo Triste, the Gulf of Cariaco and many of the lagoons in the provinces of Cumaná and Maturin. The southern branch is the old river channel, but when the land on the left bank sank gradually towards the north, part of the waters, following the new slope of this northern plane, cut into it the various channels with their connecting branches which, after a slow and tortuous course, empty into the sea between the old mouth of the river and the southern entrance of the Golfo Triste. At the time of .this movement extensive tracts of land to the north of the mountains which run through the whole length of the peninsulas of Araya and Paria were also submerged and thus the Sea of Carupano was formed. Previous to this the South American mainland (as shown by Mr. Bland in his investigation of the West Indian shell fauna) extended to Grenada, Tobago and Trinidad. Tobago is still within the 100 fathom line. It is evident that an immense quantity of organic matter must have been buried with the sunken land to form the source of the bitumen and other carbo-hydrates of the vicinity.